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RICE

RICE

PREFACE.

THE following pages, which lately appeared in *The Miller*, having attracted some attention amongst those interested in the Rice trade, I have been requested to revise them for publication in the form of a pamphlet.

This I am glad to do, because it may forward the object I had in view in writing them, which was to direct attention to a cheap food supply, now too much neglected in Great Britain. I feel that one who can succeed in doing this, to quote the words of Dean Swift, "deserves as well of mankind and does as essential "service to his country," as if he were to devote his labour to the tilling of the soil, and "make two ears of "corn or two blades of grass to grow upon a spot where "only one grew before."

With this end in view, while I regret that the subject has not been undertaken by one better able to do it justice, I commend the following pages to your favourable notice.

H. B. PROCTOR.

RICE:

ITS HISTORY, CULTURE, MANUFACTURE AND FOOD VALUE.

CHAPTER I.

ITS HISTORY.

"Thus God created man. God made food and drink, *Rice*, fire, and water, cattle, "elephants, and birds."—*A Burmese Account of the Creation.*

EXTRAORDINARY as has been the progress of the wheat trade of England during the last half century, the wheaten loaf having supplanted those of rye and barley as the staple food of all classes of the people, it nevertheless will not bear comparison when contrasted with the same movement in rice, the importation of which has increased no less than one hundred-fold during the same period.

The rice trade of England continued in extremely small compass, and was limited to the varieties produced in Carolina, Bengal, and Madras, until the year 1852, when the most fertile provinces of Burma were conquered and annexed to the British Empire.

Of all countries in the world, Burma is the best adapted for the cheap cultivation of rice; all that was wanted was a just and strong Government, able to put down petty internal warfare, and willing to protect the cultivators from excessive taxation, violence, and oppression.

These blessings, which universally attend British rule, soon changed the condition of the people from extreme poverty to the greatest prosperity. As soon as the war was over and the country became settled, the export trade in rice began, and since then it has steadily increased year by year until in 1881 the exports to Europe amounted to no less than 736,650 tons, besides which 178,600 tons were exported coastwise and to other parts of the world.

This immense addition to the rice supply of the world has not checked the trade in the same article from the rest of India, as might have been anticipated, but it has grown larger too; last year the exports to Europe amounted to 89,650 tons.

A cereal trade that is developing with such rapid strides cannot fail to be of interest to the milling world. As the subject has hitherto been somewhat overlooked and neglected by periodicals devoted to such subjects, we propose to give a short account of the history, cultivation, and manufacture of rice and its products, together with a few remarks upon its comparative food value.

RICE BERRY ENLARGED.

FIG. 1.—THE RICE PLANT—CAROLINA VARIETY.

The derivation of the word—arisi, Tamil; aruz, Arabic; oryza, Latin; riso, Italian; rice, English, points correctly to its Indian origin. It is a cultivated variety of an aquatic grass, bearing when in the ear a closer resemblance to barley than to any other of the English corn plants. (See fig. 1.) The seed vessel grows upon separate fine hair-like stalks like the

FIG. 2.—RICE SPRIG (NATURAL SIZE)—
THE RANGOON VARIETY.*

* We have been favoured by Messrs. J. & G. Bulloch & Co., of 13, Fenchurch Avenue, London, with the sprig of Rangoon rice from which our engraving was prepared.

oat, each of which springs gracefully upwards from the main stem; the grain is enclosed in a rough yellow husk, which generally terminates with a thin spike or awn, though some varieties are awnless. The height varies from 2 ft. to 6 ft. according to variety. The grain must be removed from the husk, which adheres to it with tenacity, either by being pounded in a stamper pot, or more generally by passing it through a pair of mill-stones set a slight distance apart, which crack off the husk without crushing the grain. It has next a thin skin or pellicle which must be removed by scouring or decorticating to make cleaned rice, just as barley is scoured for making pearled barley. Rice in the husk is called "Paddy" (Malay, Padi); the husk which is removed is called Rice Shude; the meal which is obtained during the scouring process is called Rice Meal.

There are far more cultivated varieties of rice differing more from each other than there are of wheat, or of any other of the grain foods. The Karens, a hill race in British Burma, have names for 40 varieties. Dr. Moore mentions 161 varieties growing in Ceylon, besides which there are those grown in China, Africa, Japan, and other parts of the world. The colours of the grain vary from coal black, dark red, pink, yellow to ivory white; the shapes are various and differ much from each other; some varieties are sweet, others bitter; some oily, others dry; some hard and translucent, others soft and chalky. Botanists have classified the varieties grown into four divisions: Early Rice, Common Rice, Clammy Rice, and Mountain Rice.

Early rice is a marsh plant. It is sown between the end of March and beginning of May. It matures in four months. It is grown mostly in India, China, and Japan. Carolina and Java rice belong to this division. The isolated attempts which have been made to grow Carolina rice in Burma have failed, because it ripens sooner than the main crop of the country, and the birds collect in such numbers as to clear off the bulk of the crop before it can be gathered in.

Common rice gives the greatest yield, about twenty-five fold. It is wholly a marsh plant; if the ground becomes dry before it arrives at maturity it soon withers away. The Burmese crop belongs to this division. It is sown in June and reaped about six months after.

Mountain rice grows on the Himalyas. It does not require irrigation and will stand great cold, pushing its way through snow. It has been grown as an experiment in England.

Clammy rice has the advantage of growing on wet or dry land: it ripens in five months; varieties of the two first divisions are those most known in commerce.

There can be no doubt that the rice plant is of Indian origin. Wild rice, growing in the waste marshes, is still eaten as a luxury on the Madras coast. The grain is small, white, and sweet; it brings a high price, but the plant does not pay to grow, because it returns so small a yield compared with the cultivated varieties.

Rice is the grain-food most preferred by half the human race. In the Indian Peninsula it is the principal food of 100,000,000 of the

people; so strongly are they impressed with the superiority of rice as a food that in Southern India a peasant will indicate his well-to-do or impoverished condition by telling you that he eats rice twice a day, or once only, or not at all. The poorest people rarely taste it; they eat varieties of millet, raggy, dari or other cheaper foods.

Tradition teaches that rice is the most ancient food of India, and as such it is invested with almost a sacred character. It is used in many of the sacrifices and other religious ceremonies. One of the purifactory rites after birth is feeding the Hindoo infant with rice during the sixth month. The Hindoo householder must daily perform the five acts of worship, the fourth of which is scattering rice grains at his door, with the prayer "Om to all the Visvadevas, to the universal gods, men, beasts, birds, reptiles, ... &c." After death comes the most important rite of all, called "Sraddha," which is offering the pinda or ball of rice,

FIG. 3.—CHINESE CLEANING RICE.

accompanied with prayers and libations to the departed spirit. The participation in this rite is accepted as evidence of kinship, and gives a title to a share of the deceased's property.

The most ancient written account of the cultivation and trade in rice, as far as I have been able to ascertain, may be found in the Shoo-King, or Chinese classic, translated in Medhurst's Ancient China, which describes the drainage and irrigation works constructed by the Emperor Yu, on the Yangtse River, about 2356 B.C., a few years before the date usually given to the Noachin deluge. It describes the mode of collecting revenue from paddy lands, as follows:—"To the distance of 500 le (140 "miles) from the Royal city was the land of feudal tenure; for the first "hundred le (28 miles), the revenue consisted of the entire plant of the "grain; for the second hundred le, they had to pay the grain and half

"the straw; for the third hundred le, they had to bring the grain in the "ear, while all these rendered feudal service; for the fourth hundred le "they paid the grain in the husk, and for the fifth hundred le they "brought the rice cleaned." A most ingenious mode of collecting the revenue where the cost of carriage is so great, and the roads so bad as they are in China to the present day.

Coming nearer home, rice may certainly take its place among the cereals cultivated in Ancient Egypt and Syria. Pliny, the naturalist, does not give it in his list of Egyptian plants, but Wilkinson considers there is abundant reason for supposing it was cultivated in the Delta. This is confirmed by the illustration here given, which is taken from a tomb at Thebes, some 3000 B.C. Wilkinson supposes that it represents the pulverising of certain substances in a mortar. If it be compared with the illustration showing the process of rice cleaning as carried on in China at the present day, there can be no doubt but that it represents the same process as it was practised in Ancient Egypt nearly 5,000 years ago. It

FIG. 4.—ANCIENT EGYPTIANS CLEANING RICE. THEBES.

(From Wilkinson's "Ancient Egyptians," New Edition; Vol. II., p. 166.)

is done by pounding the rice in wooden or stone pots, with a pointed pestle or beater; the pot is kept full of grain, so that the skin is removed by the continued trituration and friction of one grain against another, without pulverising or breaking them. Another illustration is given, showing the same process worked by the foot, which is the method preferred in Burma, Japan, and parts of China. The operation is referred to in Proverbs xxvii. 22—"Though thou shouldst bray a fool in a mortar "among wheat (grain?) with a pestle, yet will not his folly depart from "him," or as the same idea is rendered in our our own proverb, "Folly "is more than skin deep." There is no sense in the translation as given in the authorised version. The word translated "wheat" means literally "pounded grain," and undoubtedly refers to the decorticating process, which, according to Pliny and Herodotus, was applied to rice and barley but not to wheat.

Pliny's description of the rice plant seems to show that, though he

knew the grain, he had never seen it actually growing, the description is so wide from the mark. In his treatise on the food plants of India he says:—"But the most favourite food of all these is rice, from which they "prepare ptisan (pearled grain) similar to that prepared from barley in "other parts of the world. The leaves of rice are fleshy, very like those "of the leek, but broader; the stem is a cubit (18 inches) high, the "blossom purple, and root globular, like a pearl in shape."—(B. 18, cap. 13.) He goes on to say that "Hippocrates, one of the famous writers of "medical science, has devoted a whole volume to the praises of 'ptisan,' "the mode of preparing which is universally known."

The cultivation of the plant in Europe was, according to Captain Baird Smith, introduced by the Moors into Spain in the 11th century, and from thence into Italy a century later. Gibbon considers that it was cultivated in Spain before the Christian era, and that the rice was imported from Spain which was used for making the wedding cakes in the simple con-

FIG. 5.—JAPANESE RICE CLEANER.

farreation ceremonies of the old Roman Republic. Be this as it may, it is certain that it was not cultivated to any large extent in Italy until quite modern times.

Rice cultivation has always been heavily taxed, and in some of the States absolutely prohibited, owing to the malaria rising from the swampy lands. Since Italy became a kingdom, and legislation on the subject has become more uniform and less capricious, the cultivation of this, the most profitable crop to the farmer, has so extended in the rice meadows of Lombardy and other similarly situated low-lying lands, that the Italian rice crop of 1880 amounted to no less than 500,000 tons, and it is annually increasing in amount. The cultivation of rice in Georgia and Carolina, which have produced the finest seed in the whole world, only commenced about the year 1700. In a pamphlet published in London in 1701, on "The Importance of British Plantations in America," it is mentioned as

a recent circumstance that "A brigantine from the Island of Madagascar "happened to put into Charlestown, having a little rice seed left, which "the captain gave to a gentleman named Woodward. From part of this "he had a very good crop, but he was ignorant for some years how to "clean it. It was soon dispersed over the province, and by frequent "experiments and observations they found out ways of producing and "manufacturing it to so great perfection that it is thought to exceed any "other in value." Mr. Dubois, the Treasurer to the East India Company, sent a further supply of seed a few years afterwards. By careful selection of the seed, and cultivation in trenches on a suitable soil, the Carolina seed has become so famous that it has been exported to Java, Italy, Spain, Madras, and other countries. The finest Indian varieties are grown from American seed.

Since the American war and the abolition of slavery, as the free negroes object to working in the swampy rice lands, associated as they are with fever and malaria, rice cultivation is becoming less each year, and the export trade of Carolina rice to Europe, in spite of all attempts to bolster it up with protective duties, has practically ceased. The American millers are losers rather than gainers by the duty imposed for protecting the trade, which is now 2½ cents per lb., or over 100 per cent. *ad. val.* on imported cleaned rice, thus causing the American consumer to pay double for his rice. As the crop raised is smaller every year, he has not only no rice to export but must import the balance of his supply from the English or other markets. Were the duty removed the more expensive Carolina rice would again be largely exported to Europe, and be replaced by a still greater import of Burmese rice for the American home trade, to the benefit of cultivators, millers, shippers, and all concerned; a remarkable instance of injury done to a trade by the duties intended to protect it.

It is difficult to trace the time when rice was first imported into Great Britain. Shakespeare mentions it as a great luxury. The clown in *Winter's Tale*, says:—"Three pounds of sugar, five pounds of currants, "rice: what will this sister of mine do with rice? But my father "hath made her mistress of the feast, and she lays it on." The supply then came from Italy. It was superseded early in the eighteenth century by rice from our American colonies and India; we did not begin to mill rice for ourselves to any appreciable extent until the early part of the present century. McCulloch, in his Commercial Dictionary, in 1832, tells us that "a few years ago England was principally supplied with "cleaned rice direct from Carolina: latterly it has been much reduced. "An improved mode of separating the husk, which throws out the grain "clean and unbroken, has been lately practised in this country. As the "grain preserves its sweetness and flavour better during a long voyage "than when shelled, it is now principally imported rough from Bengal "and the United States. No doubt the heavy duty (15s. per cwt.) on "American cleaned rice has powerfully contributed to this result." He says the consumption, which was lately only 2,000 to 2,500 tons annually

is rapidly increasing, "partly owing to the late reduction of the duty "on Indian rice from 5s. to 1s. per cwt. It has now, however, been very "generally introduced among the middle and to a certain extent among "the lower classes; there can be little doubt that its consumption will "continue to increase according as the various qualities of this cheap and "highly useful grain come to be known. It is likely, therefore, that it "will in future form an article of importance in the trade with India."

The experiences of the last half century show how these anticipations have been more than fulfilled. The rice imports have during that period increased a hundred-fold: the increase still continues, and there is fair reason to suppose that the commercial enterprise, industry, and mechanical ingenuity of the English people will for many years to come, in spite of Continental opposition, enable them to still farther develope and retain the foremost position in the rice trade of the whole world.

CHAPTER II.

ITS CULTURE.

"A rice field produces a much greater quantity of food than the most fertile cornfield. Two crops a year, from thirty to sixty bushels each, are said to be the ordinary produce of an acre."—*Smith's Wealth of Nations.*"

IN a short description like the present it would be too tedious were I to attempt to describe the cultivation of the many varieties of the rice plant in the different countries of the world. I shall therefore confine my remarks to the branch of the subject most interesting to us, viz., the cultivation of "common rice," which is exported to Europe in such large quantities from British Burma.

The main points to notice are those which give us a fair idea of the circumstances under which rice is grown, so that we may estimate the cost of production, and the probable future development of the trade, as well as the possibility of the crops being wholly or partially injured through natural calamities. To arrive at any conclusion on these points, it will be necessary in the first place to consider the physical aspects of the country in which the crop is raised.

British Burma consists of the three provinces of Arracan, Pegu, and Tenasserim. The total area is 87,220 square miles, of which no more than one-sixteenth is cultivated; seven-sixteenths are culturable, the other half is unculturable. Of the total cultivated area eighty-eight per cent. is given up to rice, the only crop suitable for the swampy lands, of which the country so largely consists. The northern province, Arracan, chief town Akyab, with the exception of the range of mountains running parallel to the sea, consists of a strip of low-lying sea-coast, hardly above the sea level, completely intersected by a labyrinth of tidal creeks. Pegu, the middle division, chief towns Rangoon and Bassein, consists of the valleys and Deltaic swamps of the Irrawaddy and Sittoung rivers, together with the plain stretching from the Aracan range to the Martaban coast. In this province the bulk of the rice is raised, three-fifths of it alone being grown in the Irrawaddy valley. The third division, Tenasserim, which is the largest, is for the most part mountainous, and covered with dense jungle; the few rice lands of this province are towards the north on the Salween river, that empties itself into the sea at Moulmein. There are three seasons in Burma, the cold weather, which lasts from October till the middle of February; the hot season, from the

end of February till the beginning of the rains, which set in at the end of April or early in May; and the rainy season from early in May till towards the middle of October. The rainfall is unusually heavy, the average for

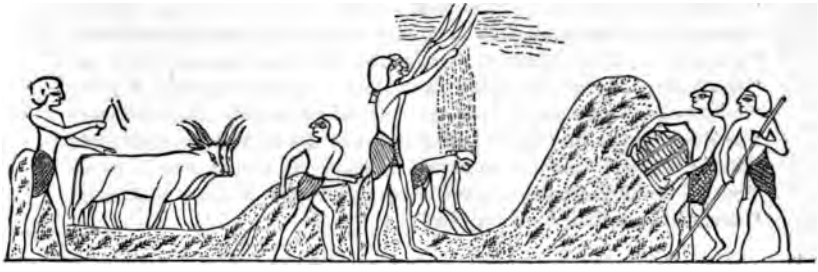


FIG. 6.—A PICTURE TAKEN FROM AN EGYPTIAN TOMB 5,000 YEARS OLD, SHOWING THE RICE THRESHING & WINNOWING PROCESS.

the whole country being 130 inches during the rainy season, and as the country is flat, with the plains but slightly above sea level, giving little fall, it is then completely flooded from end to end. With the exception of a few knolls, and the high ground at the foot of the hills, the whole of

FIG. 7.—FACSIMILE OF A BURMESE PICTURE SHOWING THE PLOUGHING PROCESS FOR RICE.

Arracan, Pegu, and a part of Tenasserim is flooded with from one foot to twelve feet or more of water, which covers fields, roads, and villages, and in fact the whole face of the country.

Captain Forbes, in his most interesting book on British Burma, thus

describes the scene :—" Boats are the only means of locomotion, even for " a few yards ; you sail across the country, ploughing through the half " submerged long grass, piloting a way through the clumps of brushwood " or small trees, into the streets of the large agricultural villages where " the cattle are seen stabled up in the houses sometimes twelve feet from " the ground ; the children are catching fish with lines through holes in " the floor ; the people are going about their everyday concerns, if it is " only to borrow a cheroot from their next-door neighbours, in canoes ; " in short, all the miseries and laughable *contretemps* sometimes pictured " in the illustrated pictures as caused by floods in Europe, may be seen, " with this difference, that everyone is so accustomed to them that they " never create a thought of surprise."

FIG. 8.—FACSIMILE OF A BURMESE PICTURE SHOWING THE PROCESS OF RICE SOWING.

This heavy rainfall is the source whence British Burma derives its wealth and prosperity. It makes it unnecessary to go to the labour of carefully levelling the rice fields for artificial irrigation as in India and other countries ; the land has simply to be cleared of the grass, weeds, and old roots, which are dragged up and used to assist in making the bunds, or small embankments, at the edges of the field, subsequently used to retain the water.

Towards the end of May, after the first rains have saturated and softened the soil to such a degree that men and oxen sink ankle deep into the soft mud, the land is cleared of weeds, and at the same time ploughed by dragging across its surface a sort of heavy wooden rake, about five feet long, with hard, wooden teeth about nine inches in length.

The paddy is sown in June after the rains have fully set in; first in the higher lands, where it is sown broadcast, about one bushel to an acre, upon the surface of the water for the purpose of forming nurseries, as well as in those fields which are not to be transplanted. After the young plants have attained the height of about eighteen inches, they are pulled up bodily by the roots and tied into bundles, which are piled high in boat-loads, to be transplanted into the fields that are by this time ploughed ready for their reception on the lower ground. The transplanting takes place in September; it is performed by women and children, and of late years, to a large extent, by imported labour from the rest of India. Sometimes the villagers turn out in a body to assist one another and work together in each other's fields, so as to push on the more rapidly with this

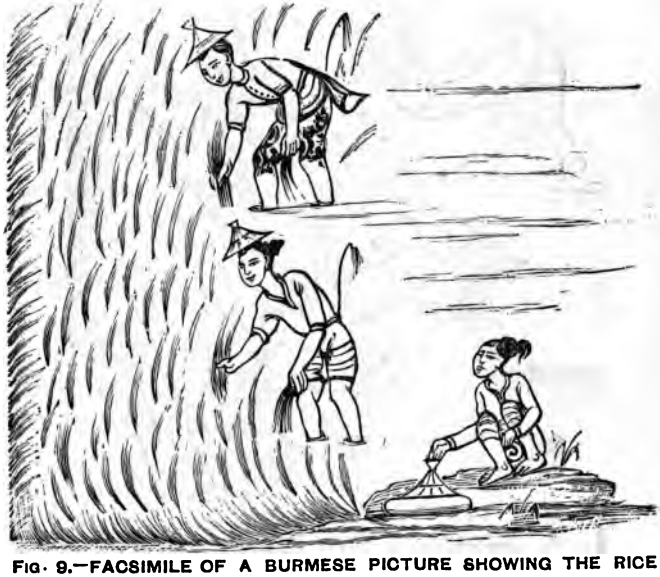


FIG. 9.—FACSIMILE OF A BURMESE PICTURE SHOWING THE RICE RE-PLANTING PROCESS.

disagreeable and fatiguing work, which necessitates a stooping position all day long, ankle deep in water and slush. The seedlings are stuck, two or three together, in the deep mud in rows about ten inches apart, in a sort of diamond pattern, either by hand, or else with a forked bamboo stick to make the stooping less painful.

The illustration, fig. 9, shows the former process of transplanting by hand; the figure seated in the foreground is the attentive wife, who has brought the dinner of curry and rice to her husband while he is working in the fields. It will be noticed in these illustrations that she wears the breeches; the black marks upon the men's legs represent the painful amount of tattooing considered necessary by a young Burman of fashion.

There is no more beautiful sight in the world than the fresh emerald

green of the tender young rice plants. Bishop Heber speaks of the paddy fields, in his journal, with great admiration, as the most beautiful features of an Indian landscape.

After the transplanting no further care is given to the crop beyond driving off the birds as it ripens; it is never weeded, nothing is done but to attend to the water supply by stopping up the openings or sluices in the bunds when the rains have ceased, so that the land does not dry up too soon. The Burmese crop the land only once a year, not three times as in other parts of our Eastern Empire. The land is never manured, rotation of crops is never dreamed off; year by year this primitive mode

FIG. 10.—FACSIMILE OF A BURMESE PICTURE SHOWING THE RICE REAPING PROCESS.

of cultivation and the heavy rains are all the land gets to bring forth an abundant harvest. The yield throughout the country averages about 1,600 lbs. per acre, in the Rangoon district it is frequently as high as 2,800 lbs. per acre.

Where so much depends upon the rainfall it is no exaggeration to say that an inch or so of water, more or less, determines whether the receding flood shall leave a bright fertile plain full of promise or a ruined waste of drowned and rotted crops. With a late and heavy monsoon thousands of acres are sometimes submerged and the crops ruined; should the floods, however, not be too late in the season, the ground is replanted a

second time, and sometimes a third time, and the cultivator possibly saves his harvest. In 1876-7 the crops were ruined by floods over no less than 171,000 acres, entailing great suffering on the people and serious remissions of the land revenue; again, in 1877-8, 65,000 acres were damaged by inundation. With an early and deficient monsoon, on the other hand, the plants are not nourished, and they yield but a scanty return.

Reaping begins about the middle of December and is over by the end of January. The crop is reaped with sickles; only the top of the stalk and the ear are cut away, the straw is left standing and afterwards burnt to manure the next year's crop. After harvest the grain is either stored in the ear in granaries, or trodden out by oxen, in the good old Eastern fashion, on threshing floors made on a piece of levelled ground covered

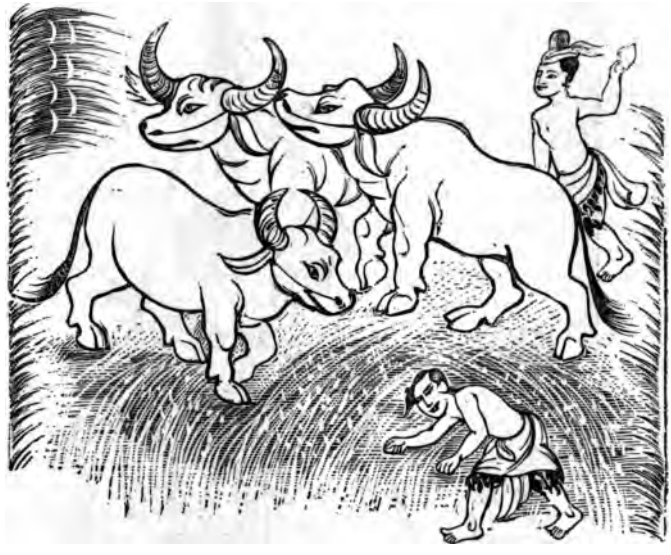


FIG. II.—FACSIMILE OF A BURMESE PICTURE SHOWING THE RICE THRESHING PROCESS BY OXEN.

with hard mud. The herdsmen unconsciously respect the divine commandment, "Thou shalt not muzzle the ox when he treadeth out the corn." This process is shown in fig. 11, also in fig. 6, taken from an Egyptian tomb about 5,000 years old. The herdsman is depicted as walking after the oxen, singing a song, one of the oldest in the world, curious from its quaint simplicity; as translated by Champollion it may be freely rendered—

"Oh! oxen, oxen, thresh for yourselves,
Thresh a little faster;
Thresh measures for yourselves,
And measures for your master."

The grain is next separated from the husk or chaff by means of a winnowing machine as in England, as well as by the more ancient way of dropping the grain and chaff together to the ground in a light breeze; it

is either thrown from light bamboo trays against the wind, or else carried up a short ladder and dropped through a sieve. These processes are referred to in the 1st psalm, "The ungodly are like the chaff which the "wind driveth away." The paddy is then either taken to market for sale or stored away in granaries built of bamboo, wattle, and daub, and raised upon piles to protect the contents during the monsoon floods. (See fig. 13.)

The price of paddy in the Rangoon market in 1819 was only £1 per 100 baskets of 50 lbs each. In 1856, just after the annexation, the price had risen to £3; in 1878, and since, the price has varied from £9 to £13 per 100 baskets. It is not surprising, therefore, when prices have

FIG. 12.—FACSIMILE OF A BURMESE PICTURE SHOWING THE RICE WINNOWING PROCESS.

increased so much above those of production, that the area under cultivation, the demand for labour, and the wealth of the country are continually increasing. During the paddy season especially the demand for labour is greater than the local supply. The rate for unskilled labourers is from 6d. to 2s. per day; the cost of food for a family of five persons is about 9d. per day, so the Burmese peasant need not infringe the golden rule laid down by Mr. Micawber, but he lives well within his income, and enjoys, on the whole, an easy and contented life. Vast numbers of labourers, attracted by the high pay, come from Orissa, Madras, and other parts of India, and from Upper Burma to work in the paddy fields

and rice mills; some only for the season, others bring their wives and families and settle. With those coming from upper Burma the case is different. Misruled by a debauched and unprincipled king, they have there no security for life and property, no interest in cultivating the soil, and escape as fast as they can to British territory. The king's officers at the frontier take rigid measures to prevent the departure of his loving subjects; unless they can smuggle off their whole family unobserved, their return is secured by the pressure put on their relatives who remain behind, and when they return after the paddy harvest is over, most of their hard earnings are extorted from them to support that inhuman despot, who loves them "not wisely but too well."

The Burmese are cheerful, temperate, and abstemious, highly intelligent, kind-hearted, and they readily fraternise with strangers; while ready to yield frankly to the superiority of a European, their independence of character commands respect. The freedom of their women, too, draws out the sympathy of Europeans. The women are great dabblers in small mercantile ventures; they receive the money for their husbands (see fig. 15), and transact all the most important business.

They smoke incessantly, and put cigarettes into their mouths six inches long and thicker than a man's thumb, covered with green leaf instead of paper, and not only do they smoke themselves, but mothers, never having heard of Dr. Richardson's theories, may be seen teaching their infants to smoke before they are able to walk.

"But what gives rise
To no little surprise,
Nobody seems one penny the worse."

Though merchants and millers have occasionally suffered from periods of trade depression, the career of the peasantry has been one of continued prosperity.

Those who twenty years ago used earthen cooking pots, cotton clothing and glass ornaments, and were obliged to content themselves with the bare necessities of life, now live in a condition of comparative luxury.

They now possess brass and copper utensils, their families are clothed in silk and satin, their houses contain cutlery, crockery, and furniture, and they adorn their persons with ornaments of gold and silver and precious stones. Besides this they spend large sums of money on Pooeys or theatrical entertainments, and are greatly addicted to the endowment of monasteries and pagodas, with which the country bristles, erected and supported by the piety of the people. Their religion is a pure form of Buddhism, which was founded by a Prince of the Sakyas in Northern India about 500 B.C. They cling to it with great devotion; there is nothing morose about it, its many festivals give it brightness, and the Burmese are perhaps the happiest people under the sun.

One of the most beautiful poems of modern times, "The Light of Asia," by Edwin Arnold, describes the life, death, and preaching of that noble hero, Prince Gautama, who founded this faith, which still gives consolation to more than half the human race.

With a short quotation from Gautama's sermon at the commencement of his public ministry, as given in it, and which gives a slight idea of his high moral teaching, I will conclude this chapter :—

. . . . . This is peace,
To conquer love of self and lust of life,
. . . . . To still the inward strife.

For love, to clasp Eternal Beauty close;
For glory, to be Lord of self; for pleasure,
To live beyond the Gods; for countless wealth,
To lay up lasting treasure.

Of perfect service rendered, duties done
In charity, soft speech, and stainless days;
These riches shall not fade away in life,
Nor any death dispraise.

Enter the Path! there spring the healing streams,
Quenching all thirst! there bloom th' immortal flowers
Carpeting all the way with joy! there throng
Swiftest and sweetest hours!

CHAPTER III.

ITS MANUFACTURE.

"'Tis a pity, cried my father, one winter's night, after a three hours' painful translation of Slawkenbergius, that Truth, brother Toby, should shut herself up in such impregnable fastnesses, and be so obstinate as not to surrender herself up sometimes upon the closest siege."—*Tristram Shandy.*

DIFFERENT varieties of rice are shipped at the different rice ports. From Rangoon two varieties; Ngatsein grain, commonly called "Rangoon," is the best, and considered to be the standard variety, being the one most largely exported. Ngakouk, shipped from the same port, is a smaller grain, rather more friable, and usually quoted at 4½d. per cwt. less money in this country. Bassein rice is rather longer and thinner in the grain than Rangoon, as well as harder and more translucent; it brings generally 1½d. to 3d. per cwt. less money. Arracan rice is soft and chalky, worth about 6d. a cwt. less than Rangoon. Moulmein rice is similar in appearance to Arracan, but with a larger and flatter grain; it fluctuates in value above and below that of Rangoon.

There is a duty of three annas a maund, about equal to 6d. per cwt. levied upon both rough and cleaned rice exported to England or other parts of the world, except British India, to which it goes free. It is difficult to account for this "self-denying ordinance," and the strange inconsistency of permitting rice to go free to our Indian possessions, and taxing the trade to our mother country to the extent of 10s. per ton.

The total amount raised by the export duty on rice in 1881 was £436,484, besides which it had to pay a large indirect duty in the form of the land tax. A strong feeling prevails in the minds of the Burmese and Indian officials that Burma pays more than her share to the Imperial revenue; it pays more by far than any other state of the same population, noless than £1,097,569 surplus revenue having been sent to Calcutta in 1880-1, and this accounts for the agitation for the remission of the export duty on rice, which was advocated by Mr. Inglish and Baboo Doorga Churn Laha at the last Budget meeting of the Supreme Council. The duty on Indian wheat was repealed in 1873; since then the wheat trade has increased so enormously as to become an important element in our supply. If English rice millers had the spirit and business capacity of Manchester cotton spinners, for instance, they would combine to petition

the Indian Secretary in support of the Burmese administrators, and this differential duty in favour of India and anachronous taxation on food would soon be a thing of the past, and the trade would have a corresponding increase at lower prices.

The Burmese are altogether too well off to take the trouble to mill much of their own rice by hand, when they can get it shelled and milled for them at a cheap rate at the rice ports. There are 49 large steam rice mills in Burma, 28 at Rangoon, and 7 at each of the other ports, Bassein, Moulmein, and Akyab. Twenty of them have machinery for turning out white rice fit for foreign markets; the others can only prepare "cargo "rice," such as is exported to be cleaned in Europe. Cargo rice consists

FIG. 13.—FACSIMILE OF A BURMESE PICTURE SHOWING CARGO AND GRANARY BOAT.

of four parts of shelled rice and one part of paddy, which is mixed with it to keep it from heating and becoming weevilled during the voyage to Europe.

The trade returns for 1880-81 show an export of white rice equivalent to 10,131,000 baskets of paddy; cargo rice, equivalent to 44,491,000 baskets of paddy. The amount consumed for food and for seed corn in the country during the same time was about equal to the total exports.

The shipping season begins in January, and the bulk of the trade is over by the end of May, though cargoes continue to be shipped until later on in the year. During the busy season the rice ports are all life and animation. The rivers and creeks are crowded with boats bringing down the paddy

to market; the brokers and buyers for the different mills put out into the stream in launches or small boats, and huxter and bargain with the owners of the paddy, and purchase the boatloads for their respective mills. The mills tear round night and day without ceasing, taking in paddy and delivering cargo rice and white rice to dhows and small steamers for the coasting trade, and to large steamers and sailing ships which are loading for all parts of the world, Europe especially. The whole surface of the water is covered with the rice husk discharged from the mills. It hides the water from view, partly fills the creeks, and lies rotting and stinking on the banks, and days before a ship arrives in port she passes through masses of paddy husk that have floated hundreds of miles out to sea.

A few years since it was computed by Mr. Layborn that the husk discharged in Rangoon annually would cover an acre of ground to a depth of 75 feet, and the disposal of so much refuse greatly exercised the minds

FIG. 14.—FACSIMILE OF A BURMESE PICTURE SHOWING THE MEASURING OF THE GRAIN.

of the municipal authorities. During the last year or two the problem has been partly solved by burning it as fuel under the steam boilers in place of coal. The experiment has been so far successful that it will, perhaps, ere long be universally adopted.

The two rice ports of England are London and Liverpool. A few years ago they used to mill two-thirds of the European imports, and the Continental rice ports the other one-third. Now, however, Bremen mills more rice than London or Liverpool, and the Continental trade continues to increase more rapidly than does the trade of this country.

The poorer classes in Northern Europe prefer rice, and find it cheaper than potatoes, whereas the home consumption among the English working classes is extremely small. England would have no trade to speak of were she not the distributing centre of the whole commercial world. It is cheaper to send cargoes of rice here to be milled, at cheap freight, when 40 per cent. of the article is consumed for home use, rather than to clean

it in Burma, and to send it in large shiploads at more expensive freight direct to foreign markets, where the arrival of so much at once brings down the price 1s. or 1s. 6d. per cwt., besides the losses incurred from heating and weevils.

As shown above, however, much cleaned rice is shipped direct, in the attempt to secure what the Burmese millers call the double profit. The result, so far, has been as follows:—They gain about 3d. per cwt. on 10 per cent. of their exports, and have brought down the price obtainable for 80 per cent. about 2s. or 2s. 6d. per cwt. The 10 per cent. is the cleaned rice exported to compete in the markets of their largest customers; the

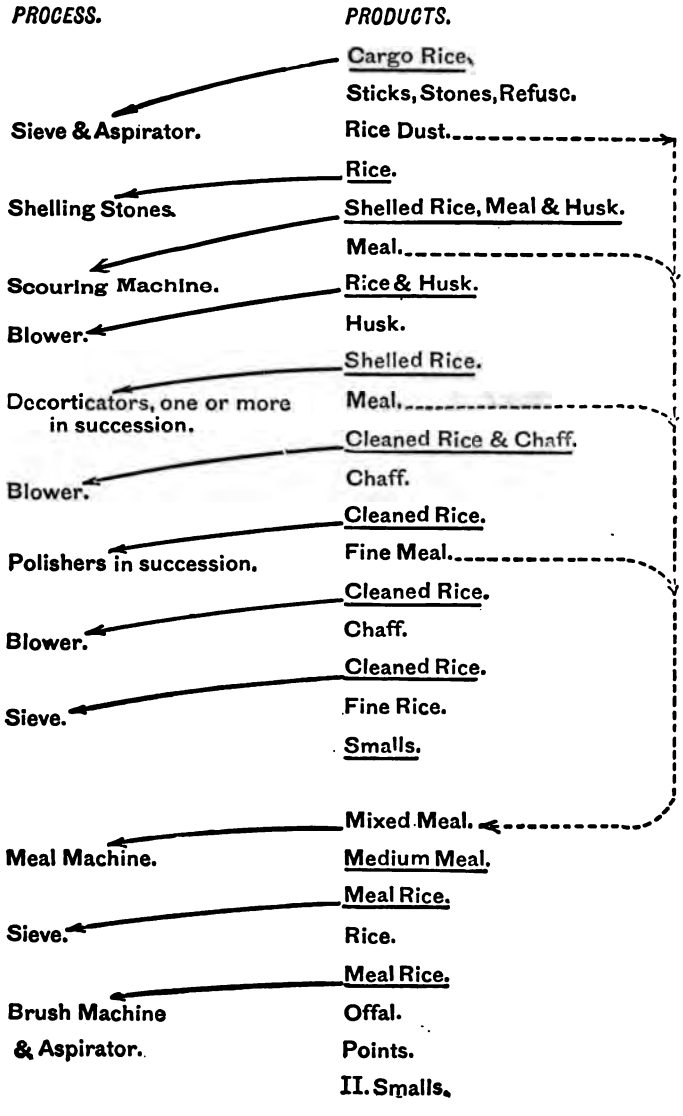
FIG. 15.—FACSIMILE OF A BURMESE PICTURE SHOWING THE PAYING OF THE CULTIVATORS.

80 per cent. is the cargo rice, that the European millers cannot afford to pay so much for, now their trade has been so much injured. Should the Burmese direct trade further develope, we may expect the competition to do still more in this direction.

We now come to rice milling in Europe. There is no need to describe in detail the elevators, creepers, hoists, &c., and the methods of handling the grain which are common to corn and rice mills; so I here give a sketch, showing the order of the different processes, and a brief account of the principal machines used to operate upon the rice.

FIG. 16.

SKETCH OF THE PROCESSES OF RICE CLEANING.



SUMMARY AND PROPORTIONS FOR NGATSEIN RICE.

Fine Rice	64	per cent.
Smalls II. Smalls Points	18	
Meal	15	,,
Husk	3	,,

Each rice miller has a system of his own, which is kept a profound secret, and which he seems firmly persuaded is capable of producing a far better result than can be obtained by any of his neighbours. A short conversation with some of our leading rice millers would go a long way towards shaking one's faith in Rochefoucauld's maxim—"A man may be

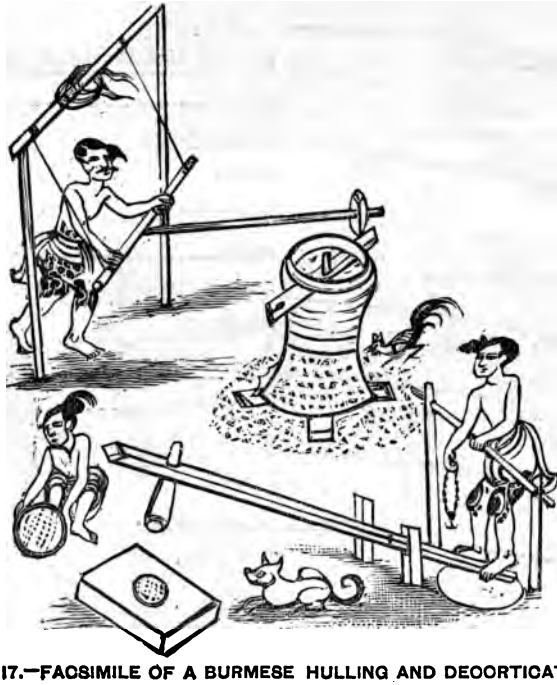


FIG. 17.—FACSIMILE OF A BURMESE HULLING AND DECORTICATING MACHINE.

"cleverer than his neighbour, but he cannot be cleverer than all his neigh-"bours." The different systems have much in common; the differences are more in the varieties of machines used than in the order of working. I have tabulated in the diagram as correctly as possible the systems now worked in the largest mills in London and Liverpool.

The end to arrive at is to obtain a white sample of rice, with the least possible breakage, the smallest abrasion, consequently the smallest quantity of meal, at the smallest cost for power and working expenses. The difference in value between the various manufactured products shows the necessity of strict attention to the smallest working details. Taking

the present value of cleaned rice at 10s. per cwt.; smalls, 8s. 3d. per cwt.; meal, 5s. 6d., with an out-turn of 100 tons per day, one per cent. more breakage means a loss of £525 a year, and one per cent. less rice and more meal, £825 a year loss. This accounts for the large sums of money that are constantly spent in the endeavour to discover machinery that will break less rice; still it is possible to get machinery that will save breakage and cost more than is saved in working expenses, wear and tear, and mechanics' pay. It may be taken as an axiom, the slower the rice is worked the less the breakage, but the larger the working cost per cwt. The difficulty is to hit upon the middle course, which avoids both extremes. In England millers seem to prefer larger out-turn, with a trifle more breakage than do the millers in the continental towns.

The rice is generally elevated first to the top storey of the mill, where it is blown or aspirated to get rid of the dust that would otherwise soon glaze the shelling stones and spoil their work. It is then sieved, either through a six-sided wire screen, or preferably through a long sieve supported on wooden springs, and worked transversely off a crank, to get rid of sticks,

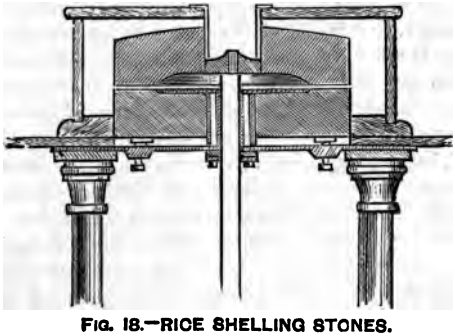


FIG. 18.—RICE SHELLING STONES.

straws, and stones; sometimes copper coin, four-anna bits and rupees, and on one celebrated historic occasion, a baby! But as Midshipman Easy's nurse said, to excuse her indiscretion, "It was only a little one." After leaving the sieve, the rice passes to the shelling-stone hoppers.

Nearly all the mills in Europe use the same system of shelling rice. A pair of 6 ft. stones of Derby grey or Newcastle stone, or any soft free sandstone, without pebbles, but large, hard, and even in the grit. The stones are dressed hollow at the eye, with a working face, perfectly true, of 9 in. wide at the rim; the stones are set about $\frac{3}{16}$ in. apart, and work at about 120 revolutions per minute. The centrifugal force impels the grain towards the periphery, and as it passes through the narrow space at the working face, the grain is tipped up on end and the husk is cracked off; when the stones run true, with good rice, the breakage is about three per cent. In some mills the rice is shelled twice and winnowed twice, but it is not apparent what is gained by shelling it in two operations.

In Burmese steam mills, where all the shelling stones used are sent

from England at a considerable cost, they now use an artificial millstone made of emery and magnesian cement. Four parts by weight of No. 18 emery are added to one part of ground calcined magnesite (a rock carbonate of magnesia), and tempered with a saturated solution of chloride of magnesium. This mixture is laid about 1 in. thick on the iron plates made specially for the purpose; it sets in a few hours and becomes hard enough for use in a few days. It is far more durable than the best millstone, and it always keeps a sharp face, owing to the difference in hardness between the emery and the cement that agglomerates it. Shelling stones covered with cork have been tried and given up in England; they are still used in Spain. In Italy a surface of hard wood set on end is sometimes used, like the Burmese native hand-mills, but they are being gradually superseded by the common shellers, either of cement or stone. The shelled rice together with the husk and meal are next passed through a screen-scourer or meal machine for the purpose of removing the meal, so that the husk can be winnowed the more readily from the grain; it is then winnowed or aspirated once or twice, and the shelled rice falls into hoppers ready for the decorticators, commonly called barley mills. Every miller in Europe employs different machinery for decorticating rice. All work with secrecy, so it is difficult to find out what machinery they use, and impossible to tell which gives the best results. My own impression is that there is very little difference, and little to choose between any of the self-acting systems. The most primitive form of decorticator used in European mills was the stamper pot, such as I illustrated in the first chapter, fig. 5, but on a larger scale. It consists of a vertical beam about 4 in. square, with a stone pestle on the lower end, that is raised some 3 ft. by a cam and dropped into an earthenware pot nearly full of rice. The operation is repeated for 10 or 20 minutes until the rice is decorticated, after which the pot is scooped empty by hand and filled with another charge. These machines are still used in country mills in Spain and Italy, worked by bullock power or water power, but they get through so little work they have long since been superseded in steam mills.

An improved form of the same machine, however, has been introduced, and is still working in Copenhagen, Flensburg, and Antwerp, and in one mill in London; when used to work the rice first, followed by some form of barley mill, they seem to give very good results. The pot is of cast iron, lined with magnesian cement and emery as described above. The pestle is of the same material, fixed on the end of a light iron rod, which is worked up and down by means of a crank and a connecting rod. The charge of rice is removed by means of a valve at the foot of the pot.

The barley mill first used for rice was the same old-fashioned machine that is used for making pearled barley; it serves the same purpose as the stamper pot, but does its work more rapidly. It consists of a circular cheese-shaped stone, 4 ft. diameter and 2 ft. wide, that revolves about 280 revolutions per minute inside a wooden case covered with fine wire netting, revolving in the same direction about 6 revolutions per minute; about 5 in. or 6 in. space is left on all sides between the stone and the casing; this

is half filled with rice while the casing is kept standing, and the machine is then started. In 10 or 15 minutes' time the rice is thoroughly decorticated, and the casing is stopped, emptied, refilled, and started again with another charge, thus requiring a constant attendant. The next improvement was to make the machine casings stop and charge themselves automatically when desired, requiring somewhat complex machinery, but giving more accurate and uniform results and saving manual labour. This led the way to continuous feed machines; they give the most certain results, and are the most readily controlled. The casings and stones are made 7 ft. or 8 ft. long, the rice is fed into the casings at one end, and at the other are slides near the periphery of the case, that can be opened or closed as desired. With the slides wide open, the rice passes through in a large feed, and is but slightly milled; when they are partly shut the rice is worked more or less as desired.

The next improvement was to replace the long cylindrical stones with

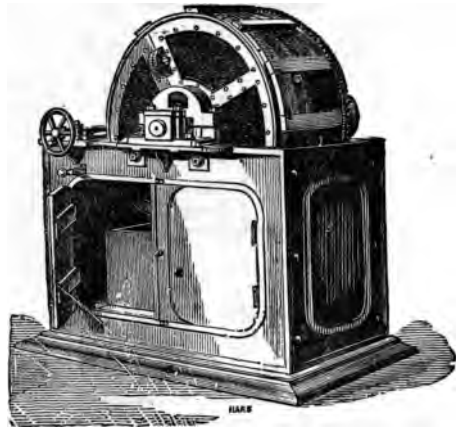


FIG. 19.—AN OLD BARLEY MILL

wooden or iron discs, or tables covered with emery composition, and fixed at a distance of a few inches apart upon the main spindle. The cement used at first was composed of emery, Roman cement, and glue, but it has been superseded by magnesian cement and emery, which is not only more durable, but it is not liable to become glazed and lose its working surface. This arrangement with emery tables requires more power to drive, because it gives nearly double the working surface of emery for the same size of case, but it puts through twice as much rice and with less breakage. All modern decorticators use emery cement for a working surface; stones have been driven out of the market. Not only are the machine repairs less, but the cement is so durable that it is estimated that 1 in. of cement will outlast some 4 ft. or 5 ft. of stone under the same circumstances.

In Bremen and Hamburg they adopt quite another system of decorticating. They use the outer edge of large stones, running like millstone

runners, but larger in diameter at the top than at the bottom, and about 18 in. thick. (See *c*, fig. 20.) They are surrounded with an adjustable wire casing partly filled with rice, which is fed on the top of the stone. They are very cumbrous and heavy to drive, besides being liable to accident with too heavy a feed. In Burma they use in some of the largest cleaned rice mills an improved form of the same machine. The cone is about 4 ft. deep by 3 ft. 6 in. and 3 ft. diameter, working inside a wire casing, leaving about $\frac{3}{4}$ in. clearance on all sides, which can be increased or reduced as desired by raising or lowering the cone. It has been lately patented in London, although similar machines have been working in Liverpool for the last seven years; this patenting of old inventions, so frequent in the rice trade, is the result of working in the dark. Having described some of the forms of decorticators most used, I shall pass on to the next process.

The rice is again winnowed to rid it of the small chaff detached by the

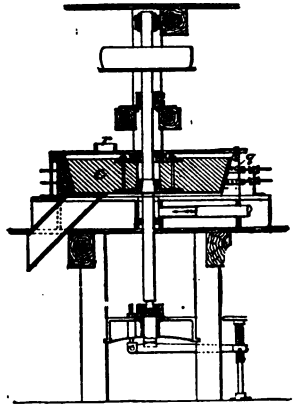


FIG. 20.—RICE DECORTICATOR (BREMEN SYSTEM).

decorticators, and it passes on to the polishers. The form of polisher varies according to the taste of the miller who uses it, but they generally consist of a sheepskin-covered drum, revolving about 1,800 ft. to 2,000 ft. per minute at the periphery, inside a wire casing, which in some forms of machine revolves slowly too. The form most frequently used is that of an inverted frustrum of a cone about the same shape as, but larger in size than, the decorticators used in Burma, and described above.

Another form of polisher is Sears' Patent. Three wooden rollers about 2 ft. 6 in. long, by 1 ft. 6 in. diameter, are covered with sheepskin and arranged as in an ordinary roller mill for softening middlings, but farther apart. They work in a closed casing with an aspirator attached to carry away the meal that is removed by the action of the rollers. These machines are not so much used as the conical polishers, but they are capable of as good work, when kept in good order. The rice is polished two or three *times in* succession; as it passes into the last polisher, a minute quantity

of indigo, toned down with rice flour to a pale blue, is generally added and brushed off again by the polisher. It gives the rice a bluish tint, that looks more like white in the jaundiced eyes of the British public, who prefer this tint to the beautiful creamy whiteness, with a faint tinge of pink, that attracts the eye of those more accustomed to distinguish its excellences. On leaving the polishers, the rice is again blown or aspirated, and last of all separated into whole rice, and broken rice, or smalls. The sieves are usually made of perforated zinc; perforated steel has been tried but its increased cost gives it no advantage over zinc. The frames are made with every variety of motion; the one most in use is that suspended at the four corners and worked with a circular motion by a central crank,

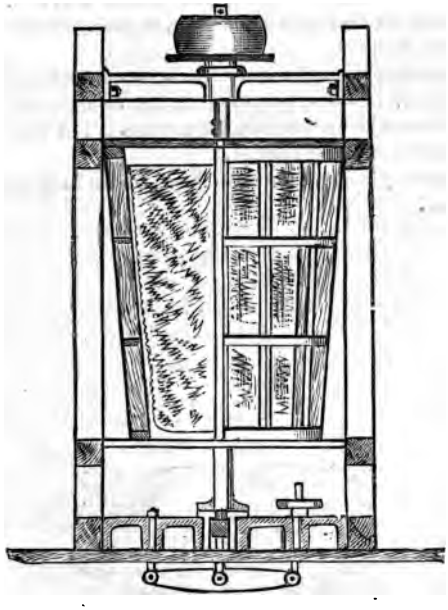


FIG. 21.—RICE POLISHER

with about 4 in. throw. This motion keeps the grain more lively and assists in bringing the light, dead paddies, known as "quakers," to the surface, and delivers them over the end of the sieve apart from the whole rice.

The rice and smalls are then drawn off and weighed into bags, usually 2 cwt., ready for sale.

The different varieties of meal obtained from the various machines are mixed together and dressed through a meal machine to make "medium "meal," which is sold for cattle feeding.

The rice, chaff, offal, and smalls coming from the tail end of the meal machine are passed through a small sieve, and the whole rice is returned

to the elevators, which lead to the polishers, to join the mainsample. The heavy offal and smalls are passed next through a Throop's brush, afterwards a Childs' aspirator, and graded into heavy offal, smalls, and points. The shude and chaff are sieved and winnowed a second time, to recover the small particles of rice blown away with them at first, and is mixed with the meal rice.

Lastly, the smalls drawn off at the sieve are ground to make rice flour. They are ground either by French burrs, or Cumberland or other freestone, that is not too hard in itself, but hard in the grit. The stones are dressed in the old-fashioned style; the usual dress is "nine threes" or "ten threes," with a good clean furrow, and not too wide. The power required is much more than for wheat grinding; a pair of 4 ft. 6 in. stones grind rather more than one sack of flour per hour, requiring about 11 or 12-horse power indicated, to drive.

Most millers dress through wire machines; some few have adopted silks. The wear and tear of the silks is considerable, owing to the sharpness of the grit, but those who use silks say the expense is less for renewing the silk covers than for wire and brushes.

I shall reserve my remarks on meal flour and the food value of rice for another chapter.

CHAPTER IV.

ITS FOOD VALUE AND ITS PRODUCTS.

"Rice is a food easy of digestion; its flour, mixed with that of wheat, when the proportion amounts to no more than a fourth, gives us a bread very agreeable to the taste and one which keeps fresh longer. When ground into flour (crème de riz) rice cooks much more readily than when it is whole. Crème de riz is a valuable food for invalids because of its digestive properties."—BOUILLET, "Dictionnaire des Sciences."

BEFORE remarking upon the food value of rice and its products, I shall give a short description of those varieties of cleaned rice that are commonly sold in grocers' shops, so that anyone can see from the sketch what variety of rice to ask for and how to distinguish it. The plate shows a full-size drawing and section of those varieties of the grain in common use, with the present price per cwt., and the proportionate consumption of each in this country.

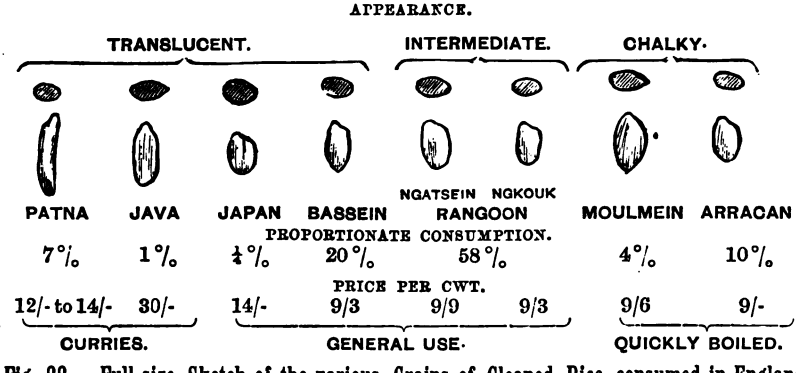


Fig. 22.—Full-size Sketch of the various Grains of Cleaned Rice consumed in England.

From this table it will be seen that the bulk of the rice which we consume or manufacture comes from British Burma, only seven per cent. from Bengal, and a very small proportion from Java and Japan.

The varieties of rice which I have illustrated differ from each other in other respects than those of form and outward appearance. Patna rice is hard, horny and translucent. It takes longer to boil than the softer grain rices, but it is the most suitable for curries and for eating plain

boiled in place of potatoes, because the boiled grains are more easily kept distinct and separate instead of boiling into a sort of pudding. Java, which is cleaned in Holland, like Patna is hard and close in the grain. It is usually more highly separated, polished, and glazed, than any rice in the market, and therefore it commands the highest price. Carolina is very like Java in shape and general appearance; since the American war its importation to Europe has almost ceased. The rice sold in shops as Carolina is either Java or what is called "Paris dressed rice," which is, as its name indicates, a Continental production. It is composed of bold, highly separated Rangoon or Bassein rice, which is polished with beeswax, stearine, oil or other fatty matter. It can easily be detected by the presence of the oil, which exhibits itself on the surface of the boiling water, as well as by the rancid and disagreeable taste and smell which it acquires after keeping for a few weeks, so the demand for this spurious article, which has of late years been imported in quantities from Hamburg, is likely to be short-lived. Rangoon is the best "all round" rice for general consumption, it makes excellent puddings, and if boiled according to the receipt which I shall give, it makes a good curry rice as well as a substitute for potatoes. Moulmein and Arracan are used mostly on the Continent, where they are preferred because they boil quickly and with little trouble. They boil in ten minutes—about one-third the time necessary to boil Patna and half the time for Rangoon. In Burma the common mode of expressing short periods of time, such as a quarter of an hour, is by saying, "the boiling of a pot of rice," or half an hour, the boiling of two pots of rice, and so on, but there, where the rice is fresh, it takes less boiling than it does in Europe.

The real reason why rice, which is so cheap and plentiful, does not enter into more general consumption in this country is because so few know how to boil it fit for table, and not many know how to prepare a good rice pudding without butter and eggs, a fault which the new schools of cookery bid fair to remedy. In the meantime it may not be out of place if I give—

A Reliable Receipt for Boiling Rice.

Put into a saucepan two quarts of water; when it boils add a table-spoonful of salt; then throw in a pint of Rangoon rice which has been picked and washed in cold water. Let it boil 20 minutes, throw it out into a cullender and strain off the hot water, then dash it over with cold water and strain once more; then put the rice back again into the same saucepan, which has been dried by the fire, and cover the pan over with a cloth and let it remain near the fire some minutes till required for dishing up. Thus prepared the grains appear well boiled but separate, instead of being mashed together.

Another reason why boiled rice, which is greatly used on the Continent, is not in this country used as a substitute for potatoes, is because the British working man fancies that it is the dearer article. He does not reflect that when he buys 4 lbs. of potatoes he gets 3 lbs. of water and

only one of food, and that 1 lb. of rice contains 3½ times as much food as 1 lb. of potatoes, as may be seen from their analysis:

	Water	Flesh formers	Starch	Total Food
Rice	13	6.5	80.	86.5
Potatoes	75	1.4	22.6	24.

Taking into account the loss in peeling the potatoes, 1 lb. of rice is clearly worth 4½ lbs. of the latter article, besides which, rice in boiling absorbs three times its weight of water; hence 1 lb. of rice, costing 1½d., when boiled exceeds in weight, bulk, and food value, 4 lbs. of boiled potatoes, costing 3d.

So much nonsense has been written against the food value of rice, founded upon insufficient knowledge and simply copied from one book into another, on the paste-pot and scissors style of writing, that, in many cases, the public ideas on the subject are steeped in prejudice and founded in error. My experience, during a residence in the East, where rice is the favourite food of the well-to-do classes, leads to directly opposite conclusions, which have the support of the most scientific authorities of the present day. I will refer, in the first instance, to the well known experiments of Dr. Frankland as to the mechanical equivalents of the heat of combustion produced by oxidising different articles of food.

Suppose that you weigh 10 stone, and wish to ascend a hill 10,000 feet high, about the same mechanical effort as walking ten miles: what quantity of food must you consume to perform this amount of mechanical work, and which variety will be the cheapest? If I reply, rice! you may say, in the words of the old gentleman in *Pink Dominoes*, "This is not what "I looked forward to."

Here is Dr. Frankland's table, however, to vouch for the correctness of the assertion, only the prices are altered to those now current.

Weight and cost of food required to raise 140 lbs. 10,000 ft. high:—

Variety of food.	Weight required, in lbs.	Cost per lb., in pence.	Total cost in pence.
Rice	1¼	1¼	1¾
Oatmeal ...	1¾	2	2½
Flour	1¾	2	2½
Bread ...	2¼	2	4½
Potatoes ...	5	¾	3¾
Lean Beef ...	3½	10	35

It is a common error to suppose that beef gives the greatest amount of motive force. Here it stands at the bottom of Dr. Frankland's list, and rice at the top.

So much for theory; now for practice. Take the case of a Burmese coolie, who lives mainly upon rice, of which he consumes about 2 lb. per day. Those who have seen him at work loading ships, and running to and fro with heavy weights in the hot season under a tropical sky, can vouch for it that he gets through more hard work in the day than does our English navvy, working in our own more temperate climate who eats meat in preference to farinaceous food.

To take another case:—The *Daily News'* correspondent in British Columbia, writing on the Chinese labour question, says: "White labour "cannot compete with men who work sixteen hours a day and live on a "little *rice* flavoured with a chunk of pork."

This must not be taken as an argument in favour of a purely rice diet; all human experience tells in favour of a mixed diet, which contains sufficient nitrogenous food to supply the waste of muscle and tissue; but experience also shows that with a liberal supply of farinaceous food, the necessary proportion of animal, leguminous, or other nitrogenous food is very small. There is no more scientific combination to attain this end than curry and rice. Not the yellow messes, made so hot with pepper and chillies as to burn the palate and injure the digestion, served with small portions of watery rice, that go by the name of curry in England, but the popular well-known Oriental dish of the same name. The true theory of a curry is to provide a *small* portion of highly spiced, or seasoned (but not too hot) fish, meat, vegetables, or eggs, to give flavour to and eat with a *large* portion of boiled rice. The spices stimulate the appetite, give the necessary variety, and make the rice more palatable, while the other ingredients give the small amount of nitrogenous food necessary to man, and in which rice, *per se*, is somewhat deficient as compared with bread or oatmeal.

In a previous chapter I stated that in the manufacture of cleaned rice the products obtained were rice, smalls or broken rice, meal, and husk or shude. Of the rice smalls produced in the London mills, a considerable part is sold direct to the manufacturers for making starch, saccharine or glucose, corn flour, and for brewing into beer, but the greater portion is ground into rice flour, which is sold to millers and bakers for dusting purposes and for mixing with wheaten flour for bread making. In Liverpool the millers grind nearly all their own smalls, very few are sold for either starch or glucose making. The bulk of the rice flour is sent to Manchester and its neighbourhood for sizing cotton goods; the rest, as in London, is sold to bakers and millers.

The amount of rice flour silently consumed in this way in Great Britain is at first sight very surprising; from the enquiries I have made, I learn that no less than 150,000 sacks of rice flour are sold in London and Liverpool every year that eventually find their way into the bread we eat.

The extract that I have given at the head of this article, from Bouillet's "Dictionary of the Sciences," shows how highly rice flour is esteemed in France for mixing into the bread. In England we draw the line at American flour, and there is great prejudice against the use of rice flour, so much so that many millers insist upon having their supplies of rice flour sent off in wheaten flour sacks, and invoiced as "flour" to prevent remark. If the proof of the bread is in the eating, who would not prefer a mixed French loaf to the inferior stuff that passes current as pure wheaten bread in the greater part of the metropolis? A mixture of ten per cent. or twenty per cent. of rice flour to the flour ground from home-

grown wheat harvested in a damp condition, is a wonderful improvement. It absorbs the moisture, improves the colour, and makes the flour keep better, besides which it bakes into a lighter and a better loaf. The point at issue between millers and bakers, for the consumer does not concern himself so long as he can get good bread at a low figure, is—

WHO SHALL DO THE MIXING?

None are so critical as the Scotch bakers about mixed flour, not so much because they object to the practice as that the canuie Scot prefers to do his own mixing, especially when rice flour is 12s. to 15s. a sack the cheaper article. They can detect the smallest percentage of rice, by repeatedly thumbing the sample when the rice flour is coarsely dressed and mixed with that from the wheat, in the old-fashioned rough-and-ready style. But as in the days when Chaucer wrote "The Reeves Tale" so now; the miller who understands his trade is too many for the baker, and he can mix rice with wheaten flour so perfectly that it requires a more highly educated thumb than Scotland or England have yet grown to detect the fact. Of course no millers would allow bakers to remain under the impression that the flour contained nothing but wheat, still less would they invoice it as "*pure* wheat flour" or the like, which would be contrary to the wise provision, for the protection of the British public, as contained in the Act William IV., sec. 6 & 7, cap. 37.

The rice flour is dressed extra fine through a No. 12 or a No. 13 Swiss silk, and instead of being mixed off in the old-fashioned way, it is fed either into the rollers or the eye of the stones with the wheaten flour, and the two are softened down together. Flour prepared like this is better than pure wheaten flour in colour, and as good in every other respect, except that the proportion of gluten it contains is diminished by 1¼ or 1 per cent., according to the quantity of rice flour used.

The percentage of gluten in wheaten flour varies from 9 per cent. to 12 per cent. in English wheats, to 15 per cent. or 16 per cent. in the Black Sea or South American varieties, 10 per cent. being considered a fair average for English wheat flour.

Suppose that you take 100 lbs. of wheat flour, containing 12 per cent. of gluten, and mix it with as much as 25 lbs. of rice flour, which contains 7 per cent.; the mixed flour will then give 11 per cent., showing that the gluten is reduced by only 1 per cent., and still leaving the flour above the average, while reducing its cost by 2s. or 3s. a sack. If the mixed flour is cheaper and will go further—and it is impossible to distinguish it from pure wheaten flour—any fancied grievance must be more or less of a sentimental character.

Suppose that you wish to have the flour analysed, it can be done in two ways (*vide* Hassall and Blyth): 1st. By observation, through the microscope; 2nd. By measuring its percentage of gluten. If the rice flour is coarsely ground and badly mixed in, the microscope will at once detect its presence; but if it is mixed away in the new style, the microscope test becomes of little or no value.

A friend of mine sent samples of flour naturally rich in gluten, mixed with 20 per cent. of rice flour in the manner described above, to five different analysts for their report upon it, and told them at the same time that he suspected its purity. Two of them reported the sample to be pure; one suspected the presence of rice; one surmised there was 5 per cent. of rice; and one, who, no doubt, knew that we live in a wicked world, replied that he could not say for certain, but he suspected 25 to 30 per cent. of rice flour. When doctors differ so much as this, their conclusions are either not very valuable, or they are founded upon very insufficient data.

The only analysis of real value to the consumer is that for measuring the percentage of gluten, or the more practical one of testing the flour in the aleurometer; it is to be hoped that, bearing this in mind, millers will be deterred from mixing rice flour into flour that is already too poor in gluten. For my own part, I buy my wheaten and rice flour separately, and mix them and bake at home. The cook uses it about one to five, not so much from motives of economy as that we prefer the bread, which we find tastes fresher and sweeter. I would recommend those who follow Cobbett's advice and bake at home to give it a trial, and those who have not read his "Cottage Economy," and who would like amusement and instruction combined, to read the article in it on baking at home without delay.

In some places rice flour scalded, or rice boiled into a jelly, is used instead of potatoes for making a ferment, though the use of the latter, which is known in the trade as "fruit," is generally preferred. Rice will do as well, and if it has no other merit it has that of cleanliness, for bakers boil down the potatoes, skins and all, mindful of the fact that we must each eat a peck of dirt before we die.

Rice flour is becoming more generally used as it becomes better known, for cones, or cones flour for dusting purposes; those who use it say that it is the best flour known for the purpose. It causes the loaves to separate freely, and they have nice brown, crispy crusts that all lovers of good bread duly appreciate.

A very small part of the rice smalls is granulated by passing through millstones, iron discs, or iron rollers for the purpose of making what grocers call "ground rice," which is used for making light puddings. It is a favourite article of food for cakes and puddings, &c., in Japan, where it is prepared by pounding rice in a mortar.

Some months ago a trade sprang up from this country to the United States in ground rice, for the purpose of mixing with hominy, which it closely resembles in every respect, and which had risen in price owing to the scarcity of maize. It appears also that it can be passed at the United States Custom House as rice flour, which is taxed at 20 per cent. *ad val.*, instead of being charged the prohibitive duty of 3 cents per lb., like whole rice and smalls.

It is singular that rice flour, or crème de riz, which is so much used as a food for invalids and children in Europe and America, is in this country quite unknown for the purpose. The only reason that I can

surmise is its extreme cheapness, because it commands a ready sale at twelve times its value under the name of an "Alimentary preparation for "Infants," and it forms the basis of several other proprietary alimentary preparations, sold to the public at prices varying from 1s. 6d. to 3s. per lb.

It is the most easily digested food that has yet been discovered; it is supposed that the extreme smallness and angularity of its starch grains, as compared with those from sago, arrowroot, tapioca, and similar foods, give it this valuable property.

Dr. Parkes says: "Rice, tripe, whipped eggs, sago, tapioca, barley, boiled "milk, raw eggs, lamb, parsnips, mashed potatoes, and fricasseed "chicken are the most easily digested substances in the order here given, "the rice disappearing from the stomach in one hour, and the fricasseed "chicken in 2¾ hours."

Rice flour besides being the cheapest is also the best of all the farinaceous foods of the sort, not only in digestibility but in food value, because it contains the largest proportion of flesh-formers, as may be seen from the following table:—

	Flesh Formers.	Farina.	Rice, per lb.
Rice Flour	6.5	93.5	1½d.
Tapioca...	2.0	98.0	5d.
Arrowroot	1.0	99.0	9d.
Corn Flour	0.	100.0	5½d.

If any of my readers would like to test the correctness of these conclusions, let them ask for some rice flour at the grocers, and if they cannot get it, send a sample order of 10 or 15 lbs. to any of our rice millers, and if they do not like it for puddings, let them mix part of it in with their next batch of bread, and they will not regret having made the experiment.

For making arrowroot, blanc mange, or light puddings, cook according to the receipts given upon the corn flour packets, but give rice flour rather longer to boil, because its starch grains have not been burst already by cooking during the manufacture, as is the case with "corn "flour," so it takes longer to boil into a jelly.

Simply boiled in milk and sweetened it is the most valuable food for infants. If preferred like arrowroot it is the best light food in the world for invalids and those troubled with dyspepsia or weak digestions; it does not cloy the appetite, and invalids will readily fancy it when they have no taste for any other food.

Many persons might hesitate to buy rice flour for infants' food without feeling sure that it was unadulterated, so I may point out that it is always sold perfectly pure, perhaps for the reason that Dr. Hassall suggests, that being so cheap no cheaper article can be found to adulterate it with.

The danger of feeding infants on "corn flour," which contains no nitrogenous food, has been repeatedly called attention to at coroners' inquests when it was too late.

Dr. W. Stone wrote to the *Times* in July, 1875:—"It could not be too "well known that corn flour, *per se*, is not food, but pure starch prepared

" by washing out of the maize flour the nutritive portion with the alkalies,
" as abundantly proved by the evidence of Dr. Bartlett before the
" Adulteration Committee of the House of Commons last autumn. . . . .
" Numerous instances of children reduced to skin and bone, from being
" fed upon one or the other of the corn flours now before the public, had
" come under his notice."

We now come to rice meal, which, as I previously mentioned, is composed of the outer skin of the rice grain, together with the " heavy offal" that is ground fine and mixed into it. The small proportion of husk that the heavy offal contains would not pay to separate; it does not materially lower the quality of the meal, and permits it to be sold somewhat cheaper. " Superfine meal" quite free from husk can be obtained by those who want it at a higher price, but the bulk of the trade is in the medium quality, which is the best for general use, price and all things considered. In appearance it is exactly like oatmeal, but its somewhat bitter taste soon informs the human palate of its real nature. It is a decided tonic, and like cotton-seed cake, it has a slightly binding effect on cattle, that makes it the more valuable a food for them when out at grass in a wet season.

" Holleth," in the *Agricultural Gazette*, thus describes its use:—" I
" have used rice meal very extensively for three seasons for my milking
" cows. I have a large contract for new milk, and keep thirty dairy cows
" to supply it. The food given them during winter, in addition to hay
" and turnips, is invariably rice meal and about 2 lb. decorticated cotton
" cake each per day. The rice meal is placed, with chopped hay or straw,
" in a large trough, well mixed up with water, and a good tubful given
" morning and evening, immediately after milking. My cows have
" milked very well upon this diet and are in good condition. The milk
" is remarkably rich, and when churned yields a large amount of butter,
" though sometimes long in churning. When, on chance occasions, I
" have been unable to obtain rice meal, and have substituted Indian meal,
" I have found a diminution in the quantity of milk. I cannot find any
" article that will produce equal results at anything near the price. I
" pay 13s. for 240 lb., always using the best kind, as I find the second
" quality very inferior. Some cattle are rather diffident about taking it
" at first, but soon take to it. I have also used it for fattening beasts,
" but in such cases mix in oatmeal, as I find the flesh thus is more solid.
" *My horses use it*, preferring it to Indian meal. I have also fed pigs
" with it, and am well satisfied with the results. I begin my young pigs
" with it, and use nothing else until about the last month, when I sub-
" stitute oatmeal. My calves, too, are brought up on it. On weaning
" them from new milk, some rice meal is taken, and scalded and well
" stirred, to prevent it from becoming lumpy; then it is thinned to the
" proper state by water, and a little new milk added. Gradually the new
" milk is taken away, then rice meal porridge becomes their sole diet
" night and morning, with plenty of hay or grass, according to the time
" of the year. In this way, whilst selling all my new milk, as nearly as

"possible, I bring up fifteen to twenty calves annually, and they are in "good healthy condition."

Although rice meal is so well spoken of by those who use it, the consumption is extremely local, and is confined to but a few of those counties in the United Kingdom that are in easy communication with London and Liverpool. In other parts of the kingdom, Yorkshire, for instance, it is practically unknown.

The British farmer is conservative in his views upon stock feeding, and he does not like to make changes until they are forced upon him by hard times, so the present high price of Indian meal may not be an unmixed evil, as it may direct his attention to other cheaper and better foods. I here give the analyses of rice and Indian meals by Norman Tate, Esq., of Liverpool, which I take from a circular which has been placed at my disposal, as well as the analysis of rice husk from Kensington's analysis of foods.

	Rice Meal.	Indian Meal.	Rice Husk.
Flesh Formers	12.30	11.27	4.18
Oil and Fatty Matter	9.0	6.50	1.10
Starch, Sugar, &c.	57.0	60.98	44.94
Woody Fibre	4.40	5.02	26.80
Ash	7.20	1.27	13.18
Moisture	10.10	14.96	9.80
Total Food	78.30	78.75	50.22

From the above it will be seen that rice meal and Indian meal are of about the same food value, though Indian meal costs on an average half as much again as rice meal. It takes a long time to get new feeding stuffs into consumption; in some parts of England even Indian meal is not yet used.

Lastly, we come to the rice shude, a word that I cannot find in the dictionary, but it is perhaps an adaptation of the word shuck (*i.e.*, husk), shucked, shude. A large portion of such of it as is quite clean and free from rice dust is exported to Holland and Germany for packing gin and other articles. It is both more elastic and more valuable for packing than sawdust, because it does not shake to the bottom and leave the bottles to smash themselves together at the top of the case. Such as is not sold for packing is ground and dressed into a fine meal for export to Germany, and for adulterating linseed cake, rice meal, Indian meal, and other feeding stuffs.

The demand for ground shude has increased so much of late years, that while some ten years ago millers were glad to give away the shude gratis, it now sells at 20s. to 30s. per ton. It is satisfactory to know that ground shude contains at least 50 per cent. of food, about the same percentage as straw, though from its appearance it does not look tempting. It is to be hoped that the husks which the prodigal son longed for and the swine refused were a trifle more appetising.

The coarser portion dressed out of the ground shude after grinding is called shude bran. It is sold for polishing tin plates. The *ash* of rice

shude contains 89 per cent. of silica, which gives it the hardness and bite necessary for this purpose.

Before closing I may say a word as to rough rice for feeding poultry and cattle. Rough rice would be largely used for fattening poultry, were it not for an extraordinary and unfounded delusion that it makes them blind. No one has ever been able to make a fowl sufficiently blind by feeding it on rice as to induce it to refuse more when it was hungry, but such superstitions have generally some foundation. Sailors, who are an observing class of men, call rice "strike me blind." On making inquiries, I am told it is well known that hungry rats go blind, and even die after over-eating themselves in a rice warehouse, but I should be sorry to vouch for the truth of the story without further inquiry. As for the fowls, they are apt to fill their crops too full of dry rice, when fed upon it for the first time, and it causes them pain and inconvenience, but nothing more, and they soon learn not to do so. But the rice should be scalded or soaked over-night before using; then it is the best and cheapest grain fowls can have.

The Chinese prefer rice for feeding fowls to all other food, and they give the flesh of capons that have been fattened on rice as a specific for the cure of consumptive patients. For fattening fowls quickly they are cooped up and fed several times a day with scalded rice that has a small quantity of hogs' lard mixed with it; in Paris the same mode is adopted, except that oil is substituted for the lard. This style of feeding is said to make the flesh beautifully white, and the legs have no hard stringy tendons in them.

"Fowl rice" consists generally of ships' sweepings and loose collected rice, which is mixed with linseed, wheat, and, perhaps, small stones, which, though the miller cannot separate, the fowls can. This fact is made use of in the Indian story of a princess who broke her pearl necklace upon a heap of rice, and when she could not find the pearls she sent for the poultry to eat up the grain, and she easily recovered them all.

It is not generally known that paddy is the food universally used for feeding cattle and horses in those countries where it is cheaply produced. In British Burma the consumption for this purpose alone was last year no less than 50,000 tons.

The experiment of feeding cart-horses on cargo rice, which has less husk than paddy, is now being tried in Liverpool with considerable success. The rice is used just as imported; it is not crushed or steeped in water over night, like the paddy used for the same purpose in Burma. The proportions used are about four parts of rice to one of crushed maize, and half of crushed beans, mixed with the usual quantity of chopped hay; and the good condition of the horses proves the success of the experiment. At the present moment Arracan cargo rice in Liverpool is 1s. 10d. a cental cheaper than mixed American maize; but it, on the other hand, is dearer than rice meal, which is so much used in Derbyshire and other midland counties for the same purpose; but team owners prefer harder food for horses so hard worked as those in that city.

These few remarks upon rice may now be brought to a close. We have seen that it has an ancient history; that it is the favourite food of more than half the human race; that the trade to this country has increased over 100-fold during the last 50 years; that the supply from Burma seems inexhaustible, the country is as yet little developed, and the trade perhaps only in its infancy. Finally we have inquired into its manufacture and products and their food value for man and beast. I conclude by hoping that the subject has been found sufficiently interesting, that now a beginning has been made, rice milling may improve by criticism and the interchange of ideas to the same signal extent as has wheat milling under the auspices of your valuable paper.

COMPARATIVE PRICES OF RICE MEAL AND RICE FLOUR.

Pack. 240 lb.	Cental. 100 lb.	Ton. 2,240 lb.	Sack. 280 lb.	Cental. 100 lb.	Ton. 2,240 lb.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
0 8 0	0 3 4	3 14 8	1 2 2	0 7 11	8 17 4
0 9 0	0 3 9	4 4 0	1 4 0½	0 8 7	9 12 4
0 10 0	0 4 2	4 13 4	1 6 1½	0 9 4	10 9 0
0 11 0	0 4 7	5 2 8	1 8 0	0 10 0	11 4 0
0 12 0	0 5 0	5 12 0	1 10 1½	0 10 9	12 0 10
0 13 0	0 5 5	6 1 4	1 12 2½	0 11 6	12 17 8

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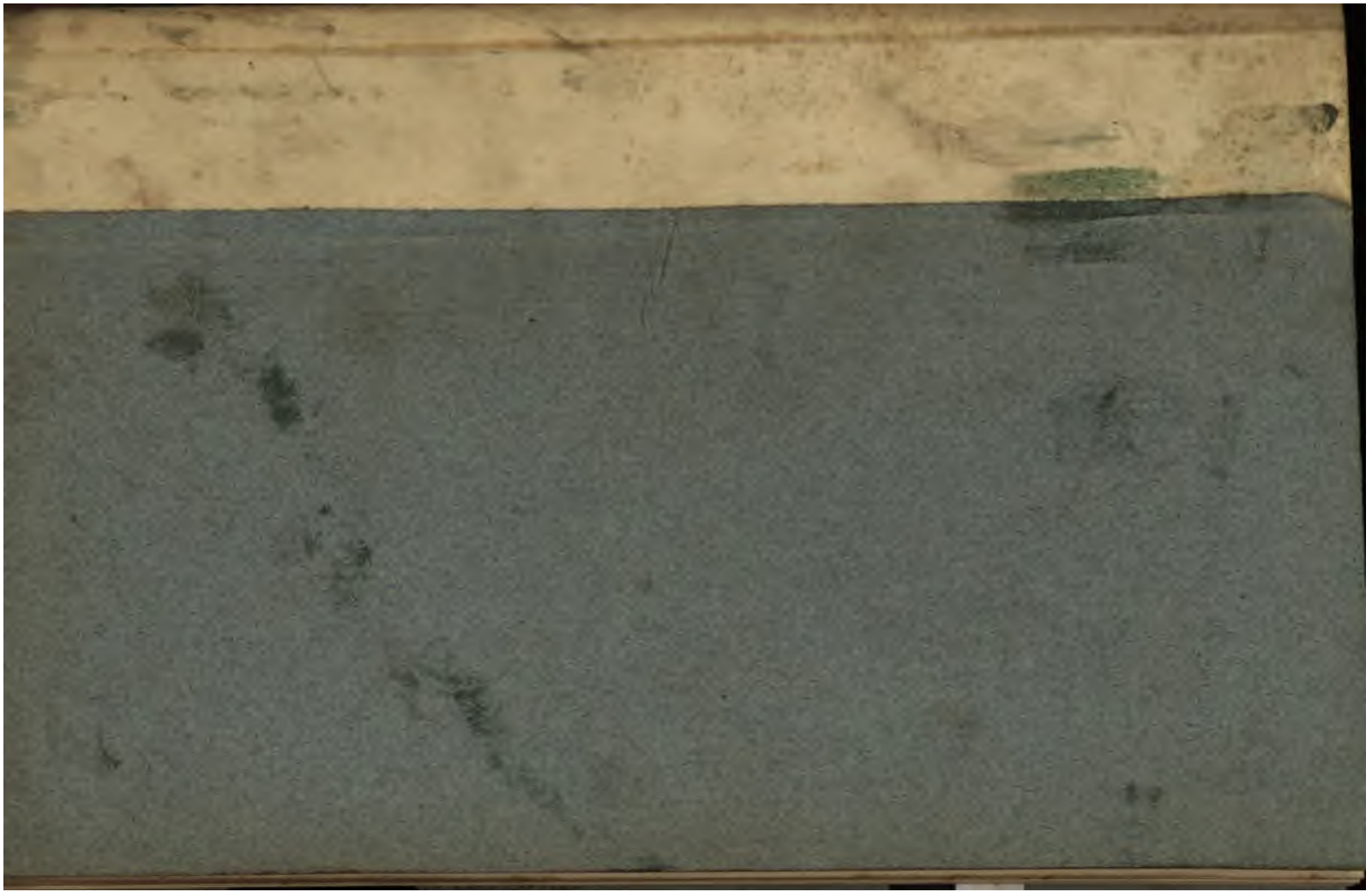
RICE MEAL
OR HOW TO
GROW FAT
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